

Architectural Programming

by Edith Cherry, [FAIA](#), [ASLA](#) and John Petronis, [AIA](#), [AICP](#)

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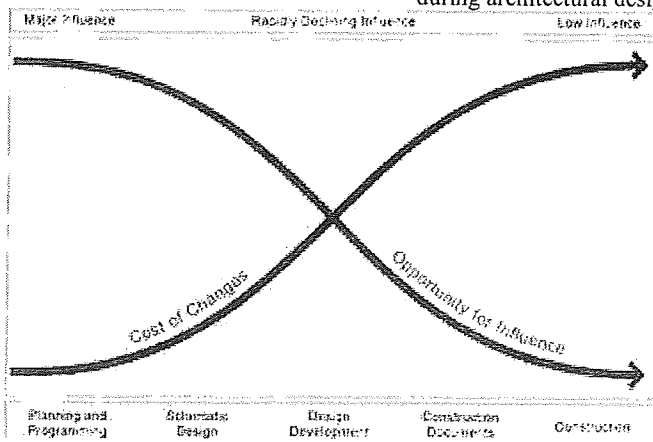
INTRODUCTION

Architectural programming began when architecture began. Structures have always been based on programs: decisions were made, something was designed, built and occupied. In a way, archaeologists excavate buildings to try to determine their programs.

Today, we define architectural programming as the research and decision-making process that identifies the scope of work to be designed. Synonyms include "facility programming," "functional and operational requirements," and "scoping." In the early 1960s, William Peña, John Focke, and Bill Caudill of Caudill, Rowlett, and Scott (CRS) developed a process for organizing programming efforts. Their work was documented in *Problem Seeking*, the text that guided many architects and clients who sought to identify the scope of a design problem prior to beginning the design, which is intended to solve the problem.

In the 1980s and 1990s, some architectural schools began to drop architectural programming from their curricula. The emphasis of the Post-Modern and Deconstruction agendas was instead on form-making. Programming and its attention to the users of buildings was not a priority. Now, several generations of architects have little familiarity with architectural programming and the advantages it offers:

- Involvement of interested parties in the definition of the scope of work prior to the design effort
- Emphasis on gathering and analyzing data early in the process so that the design is based upon sound decisions
- Efficiencies gained by avoiding redesign and more redesign as requirements emerge during architectural design.



The most cost-effective time to make changes is during programming. This phase of a project is the best time for interested parties to influence the outcome of a project.

The "whole building" design approach is intended "to create a successful high-performance building." To achieve that goal, we must apply the integrated design approach to the project during the planning and programming phases. People involved in the building design should interact closely throughout the design process. The owner, building occupants, and operation and maintenance personnel should be involved to contribute their understanding of how the building and its systems will work for them once they occupy it. The fundamental challenge of "whole building" design is to understand that all building systems are interdependent. (Source: WBDG Web site, the goal of "Whole Building" design).

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DESCRIPTION

According to standard AIA agreements, programming is the responsibility of the owner. However, the owner's programmatic direction can vary from vague to very specific. In some cases, the owner does not have the expertise to develop the program and must use the services of a programming consultant. Most programming consultants are either architects or have architectural training, but others have become skilled through experience. Many architects perform programming as an additional service to their standard contracts. Many building type consultants (laboratory, health care, theater, etc.) have expertise in programming components of facilities.

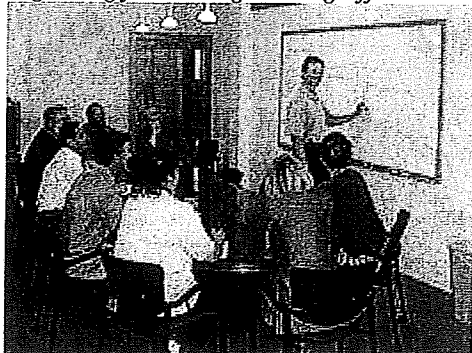
Levels of Programming

Programming may happen for different purposes and may impact the level of detail of investigation and deliverables. For instance, programming at the master planning level is more strategic in nature—providing information to building owners to make decisions regarding current and projected space needs and rough budgeting for implementation. Programming at the individual project level provides specific, detailed information to guide building design.

An Architectural Programming Process

The following discussion is intended to provide a clear process for conducting the research and decision-making that defines the scope of work for the design effort. It is imperative that the major decision-maker—the client-owner—allows participation of all of the stakeholders, or the client-users, who are affected by the design. Experience has shown that client-users' involvement in the programming process results in designs that can be optimized more efficiently.

Organizing for the Programming Effort



Design programming should involve the parties that are affected by the design solution.

Prior to the beginning of the process of programming a project, the programmer and the client-owner develop a list of the stakeholders to be involved. One organizational method is to form a Project Programming Committee with representatives from the stakeholder groups. For example, if the project is to be an office/classroom building for the humanities department at an institution of higher education, the Project Programming Committee could include representatives from the involved academic department(s), faculty, students, and building operations and facility maintenance departments.

Lines of communication must be established to determine how and when meetings will be called, what the agenda will be, how contacts will be made, and how records of the meetings will be kept. The authority of the committee must be made clear. In the example above, the committee's authority will be to make recommendations to the college authorities. Within that framework, the committee must decide how it will make decisions as a committee (by consensus? majority rule? other means?).

A Six-Step Process

1.
Research the Project Type
2.
Establish Goals and Objectives
3.
Gather Relevant Information
4.
Identify Strategies
5.
Determine Quantitative Requirements
6.
Summarize the Program

Many different programming formats incorporate the same essential elements. In all cases, the design programming fits within a larger context of planning efforts which can also be programmed. For design programming for a building, we propose a six-step process as follows:

1. Research the project type
2. Establish goals and objectives
3. Gather relevant information
4. Identify strategies
5. Determine quantitative requirements

6. Summarize the program

1) Research the Project Type

This step is necessary if the programmer is working on a project type for the first time. The programmer should become familiar with some of the following relevant information:

- The types of spaces frequently included in the building type,
- The space criteria (number of square feet per person or unit) for those spaces,
- Typical relationships of spaces for these functions,
- Typical ratios of net assignable square footage (NASF—areas that are assigned to a function) to gross square footage (GSF—total area to the outside walls) for this building type,
- Typical costs per square foot for this building type,
- Typical site requirements for the project type,
- Regional issues that might alter the accuracy of the data above in the case of this project, and
- Technical, mechanical, electrical, security, or other issues unique to the project type.

This information can be obtained from literature on the building type, analysis of plans of existing projects, expert consultants familiar with the building type, and/or cost estimating services.

2) Establish Goals and Objectives

Working with the committee, the programmer solicits and suggests broad goal statements that will guide the remainder of the programming process. (See [Design Objectives](#) on the WBDG Web site.) Each of the following categories of goals should be addressed:

- *Organizational Goals:* What are the goals of the owners? Where do they see their organization headed? How does this architectural project fit into this broad picture?
- *Form and Image Goals:* What should be the aesthetic and psychological impact of the design? How should it relate to the surroundings? Should its image be similar to or distinct from its neighbors? From other buildings belonging to the owner that are located elsewhere? Are there historic, cultural, and/or context implications?
- *Function Goals:* What major functions will take place in the building? How many people are to be accommodated? How might the building design enhance or impact occupant interactions?
- *Economic Goals:* What is the total project budget? What is the attitude toward initial costs versus long-range operating and maintenance costs? What level of quality is desired (often stated in relation to other existing projects)? What is the attitude toward conservation of resources and sustainability (energy, water, etc.)?
- *Time Goals:* When is the project to be occupied? What types of changes are expected over the next 5, 10, 15, and 20 years?
- *Management Goals:* These goals are not so much an issue of the nature of the project as they are the circumstances of the owner, clients, programmer, or architect. For example, perhaps the schematic design must be completed in time for a legislative request application deadline.

3) Gather Relevant Information

Based upon the goals, the categories of relevant information can be determined and researched. Typical categories include:

- Facility users, activities, and schedules: Who is doing what, how many people are doing each activity, and when are they doing it?

- What equipment is necessary for activities to function properly? What is the size of the equipment?
- What aspects of the project need to be projected into the future? What is the history of growth of each aspect that requires projection?
- What are the space criteria (square feet per person or unit) for the functions to take place?
- What other design criteria may affect architectural programming: access to daylight, acoustics, accessibility, campus/area design guidelines, historic preservation, etc.?
- Are there licensing or policy standards for minimum area for various functions? What are these standards?
- What are the energy usage and requirements?
- What code information may affect programming decisions?
- Site analysis: the site is always a major aspect of the design problem and therefore should be included in the program. Site analysis components that often affect design include:
 - Legal description
 - Zoning, design guidelines, and deed restrictions and requirements
 - Traffic (bus, automobile, and pedestrian) considerations
 - Utility availability (a potentially high cost item)
 - Topography
 - Views
 - Built features
 - Climate (if not familiar to the designer)
 - Vegetation and wildlife
 - Client's existing facility as a resource
 - If the client is already participating in the activities to be housed in the new facility, it may be possible to make use of information at hand. Determine if the existing facility is satisfactory or obsolete as a resource.
 - If a floor plan exists, do a square foot take-off of the areas for various functions. Determine the building efficiency (the ratio of existing net-to-gross area). This ratio is useful in establishing the building efficiency target for the new facility.
 - If the client is a repeat builder (school districts, public library, public office building, etc.), obtain plans and do area take-offs; determine typical building efficiencies.
 - Use the existing square footages for comparison when you propose future amounts of space. People can relate to what they already have. (See illustration above in *Step 5, Determine quantitative requirements.*)

4) Identify Strategies

Programmatic strategies suggest a way to accomplish the goals given what one now knows about the opportunities and constraints. A familiar example of a programmatic strategy is the relationship or "bubble" diagram. These diagrams indicate what functions should be near each other in order for the project to function smoothly. Relationship diagrams can also indicate the desired circulation connections between spaces, what spaces require security or audio privacy, or other aspects of special relationships.

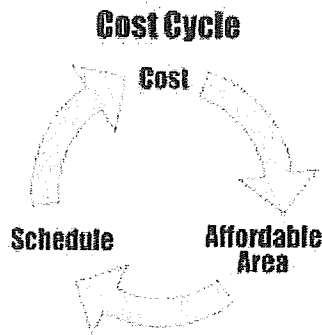
Other types of strategies recur in programs for many different types of projects. Some examples of common categories of programmatic strategies include:

- *Centralization and decentralization:* What function components are grouped together and which are segregated? For example, in some offices the copying function is centralized, while in others there are copiers for each department.

- *Flexibility:* What types of changes are expected for various functions? Do facilities need to change over a period of a few hours? A few days? A summer recess? Or is an addition what is really needed?
- *Flow:* What goods, services, and people move through the project? What is needed at each step of the way to accommodate that flow?
- *Priorities and phasing:* What are the most important functions of the project? What could be added later? Are there ongoing existing operations that must be maintained?
- *Levels of access:* Who is allowed where? What security levels are there?

Ideally, each of the goals and objectives identified in Step 2 will have some sort of strategy for addressing that goal. Otherwise, either the goal is not very important, or more discussion is required to address how to achieve that goal or objective.

5) Determine Quantitative Requirements

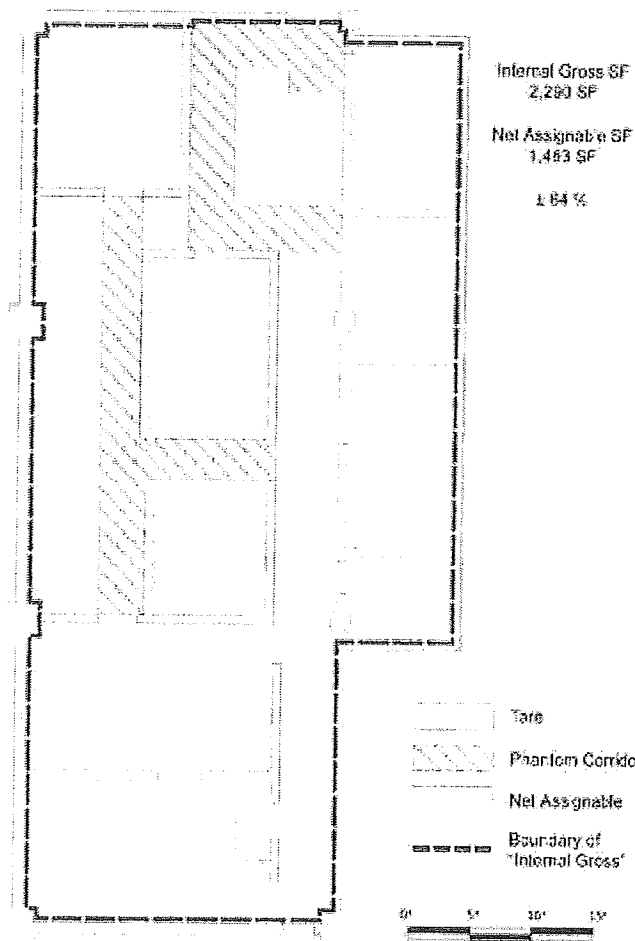


Cost, schedule, and affordable area are interdependent. Costs are affected by inflation through time. Affordable area is determined by available budgets.

In this step, one must reconcile the available budget with the amount of improvements desired within the project time frame. First, a list of spaces is developed to accommodate all of the activities desired (see Exhibit A). The space criteria researched in Step 3 are the basis of this list of space requirements. The space requirements are listed as net assignable square feet (NASF), referring to the space assigned to an activity, not including circulation to that space.

A percentage for "tare" space is added to the total NASF. Tare space is the area needed for circulation, walls, mechanical, electrical and telephone equipment, wall thickness, and public toilets. Building efficiency is the ratio of NASF to gross square feet (GSF), the total area including the NASF and tare areas. Building efficiency equals $NASF/GSF$. The building efficiency for a building type was researched in Step 1 and possibly Step 3. See Exhibit A for an example of space requirements.

The building efficiency of an existing space used by a client can inform the selection of the net-to-gross ratio. The example below of an office suite within an office building illustrates the areas of net assignable square feet and tare area. Notice that some space within an office is considered circulation, even though it is not delineated with walls. We call this circulation, "phantom corridor."



In the case of a tenant improvement within a larger building, one establishes the "internal gross" of the leased space. Additional support space or tare area such as mechanical rooms and public toilets would not be included in the calculation for this project type.

The desired GSF is then tested against the available budget (see Exhibit B). In drafting the total project cost, the programmer uses the cost per square foot amount researched in Step 1. Factors for inflation should be included, based upon the project schedule. Costs should be projected to the date of the mid-point of construction because bidders calculate estimates on the assumption that costs could change from the time of the bid date.

The total project cost includes the construction cost (for building and site work), plus amounts for architect's fees, furniture and equipment, communications, contingency, printing for bid sets, contingency, soils tests, topological surveys, and any other costs that must come from the owner's budget. The intention is to help the owner prepare for all the project costs, not just those costs assigned to construction.

If the bottom line for the project costs is more than the budget, three things can happen: 1) space can be trimmed back or delegated to a later phase (a reduction in quantity); 2) the cost per square foot can be reduced (a reduction in quality); or 3) both. This reconciliation of the desired space and the available budget is critical to defining a realistic scope of work.

6) Summarize the Program

Finally, once all of the preceding steps are executed, summary statements can be written defining "in a nut shell" the results of the programming effort. All of the pertinent information included above can be documented for the owner, committee members, and the design team as well. The decision-makers should sign-off on the scope of work as described in the program.

Once a program is completed and approved by the client, the information must be integrated into the design process. Some clients want the programmer to stay involved after the programming phase to insure that the requirements defined in the program are realized in the design work.

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EMERGING ISSUES

Some of the emerging issues in the discipline of architectural programming include:

1. Development of standards and guidelines for owners that build similar facilities frequently. These efforts include:
 - a. Formalizing (computerizing) building facility requirements for Web-based consumption—for example, the National Park Service has developed Facility Planning Model Web-based software to assist park superintendents and other staff in the development of space and cost predictions for legislative requests. The intention is to make budget requests more realistic and more comprehensive.
 - b. Facility programming to make early predictions to aid in early capital budgeting
2. Client-owners are increasingly requiring verification that the design complies with the program.
3. New technologies are generating a need for types of space which have no precedents. Basic research on these technologies is required to determine standards and guidelines.
4. As more clients require measures for building energy and resource conservation standards (LEED, Green Globes, etc), the programming process needs to reflect these requirements in goals, costs, scheduling, and process.
5. The supply of facility programmers is smaller than the demand. More professionals need to consider this sub-discipline as a career path.

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RELEVANT CODES AND STANDARDS

A very important part of programming is identifying relevant codes and standards that apply to the project (see Steps 1 and 3 above). Codes, covenants, deed restrictions, zoning requirements, licensing requirements, and other legal obligations can have significant influence on costs and therefore, affordable GSF. These factors must be identified prior to design.

Many governments and institutions have developed standards and guidelines for space allocations. For example, the General Services Administration (GSA), military, and higher education institutions all have standards and guidelines. These standards must be adhered to in programming projects for these clients. The standards are also useful as guidelines for agencies that have not developed their own standards.

Some standards are mandated by statutes in some jurisdictions for licensing, accreditation, or equity purposes. Schools, hospitals, correctional facilities, and other licensed or accredited institutions may be required to meet these standards prior to opening their doors.

Some building codes identify the number of square feet allocated per person for certain types of occupancy. However, while these ratios may determine the legal occupancy numbers for the facility, exiting requirements, fire separations, etc., they represent the minimum requirements. It may be necessary to accommodate specific activities adequately with more space.

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MAJOR RESOURCES

WBDG

Design Guidance

[Space Types](#), [Building Types](#)

[Documents and References](#)

[Case Studies](#), [Federal Mandates](#)

Design Disciplines

[Cost Estimating](#) for a discussion of conceptual cost estimating.

Design Objectives

[Cost-Effective](#) for additional cost estimating software resources.

Sources for Space Criteria and Project Type Research

Graphic standards and other design standard sources:

- AIA Building Types series
- School Districts and/or Departments of Education
- *National Park Service Facility Planning Models (Museum Collection Facility, Maintenance Facility, Education Facility, Visitor Facility and Administration Facility)* by Architectural Research Consultants, Incorporated: Albuquerque, NM, 2004-2005. Computer software.
- Accrediting agencies
- State, county, and municipal, licensing and regulatory agencies.

Bibliography

- *Architectural Programming: Creative Techniques for Design Professionals* by R. Kumlin. New York, NY: McGraw-Hill, Inc., 1995.
- *Architectural Programming, Information Management for Design* by D.P. Duerk. New York, NY: Van Nostrand Reinhold, 1993.
- "Facilities Planning on a Large Scale: New Mexico State Police Facilities Master Plan" by John Petronis, AIA, AICP in *Programming the Built Environment* edited Wolfgang F. E. Preiser. New York, NY: Van Nostrand Reinhold, 1985.
- Chapter 12.1, "Programming" by Edith Cherry, FAIA, ASLA, in *The Architect's Handbook of Professional Practice* by American Institute of Architects. Washington D.C., 2008.
- *Problem Seeking: An Architectural Programming Primer, 4th Edition* by W.M. Peña and S.A. Parshall. New York, NY: John Wiley & Sons, Inc., 2001.
- *Professional Practice in Facility Programming* by W.F.E. Preiser. New York, NY: Van Nostrand Reinhold, 1993.
- *Programming for Design: From Theory to Practice* by E. Cherry. New York, NY: John Wiley & Sons, Inc., 1998.
- *Programming the Built Environment* by W.F.E. Preiser. New York, NY: Van Nostrand Reinhold, 1985 ed.
- *Project Programming, A Growing Architectural Service* by E.T. White. Tucson, Arizona: Architectural Media Ltd., 1991.

- *Square Foot Cost Data and Building Construction Cost Data* by RS Means. 100 Construction Plaza, P.O. Box 800, Kingston, MA, 02364-0800, issued annually.
- *"Values: A Theoretical Foundation for Architectural Programming"* in *Programming the Built Environment* by R. Hershberger. New York, NY: Van Nostrand Reinhold, 1985.

Exhibit A: Space Requirements (PDF 86 KB, 2 pgs)

In this example of space requirements, the list is divided into two parts representing space with significantly different construction costs.

Exhibit B: Example of a Total Project Budget (PDF 51 KB, 1 pg)

Note that the Construction Cost, Line E, is significantly less than the Total Project Cost. The client needs to know what the total project will cost, not just the construction cost.